MITOCHONDRIAL DNA VARIATION
in SANTA CRUZ ISLANDERS

K. Green (U. of Michigan), J. Friedlaender (Temple), & D. A. Merriwether (U. of Michigan)

The mode by which ancestors of the Polynesians arrived at the first set of uninhabited Pacific islands, and their relationship to the diverse peoples already inhabiting intervening islands, has been a controversial issue of much interest to anthropologists. Proponents of the "express train" model assert that a rapid migration of seafaring Polynesian ancestors out of Southeast Asia, hopped along the coasts of intervening islands in a transient manner, thereby maintaining biological and cultural distinctions from the inland populations. A competing theory, dubbed the "voyaging corridor" model, asserts that diffusions rather than discrete migrations took place over a longer span of time. Moreover, it involved complex interactions between the ancestors of the Polynesians and the indigenous populations. This would imply a primarily indigenous Melanesian origin for the ancestors of the Polynesians.

Past studies have indicated a strong association between a set of mitochondrial DNA 9 base pair deletion haplotypes with Polynesians and their Austronesian ancestors. These haplotypes were found to be absent in a sampling of New Guinea Highlanders and Australian Aborigines. Our own data shows the deletion is also lacking in some non-Austronesian populations (the Baining of New Britain and the Aita of Bougainville). These results indicate that the 9 base pair deletion has not yet spread through many populations in these regions, and therefore lends support to the "express train" model of Austronesian migrations from east to west.

In this study, we have extended this analysis by sequencing the mitochondrial DNA D-loop region between nucleotides 15975 and 00430 for 62 unrelated individuals from a non-Austronesian speaking group living in the Santa Cruz islands. D-loop sequences from 9-bp deleted individuals are compared to published Polynesian sequences, and we characterize the non-deleted haplotypes to define the "indigenous" Melanesian lineages.

This work was supported partially by NSF Award # 9601020 and the Department of Anthropology of the University of Michigan.

Variability in the Human *M. Spinalis Capitis et Cervicis*: Frequencies and Definitions. T.M. GREINER, M.E. BEDFORD, and R.A. WALKER Department of Anatomy, New York Chiropractic College, Seneca Falls, NY 13148

Descriptions of epaxial musculature commonly identify spinalis as the medial most component of the erector spinae group. Spinalis can be subdivided into three generalized regional components: Spinalis Thoracis, which spans the spinous processes of the thoracic vertebrae; Spinalis Cervicis, which connects spinous processes of the upper thoracic and cervical vertebrae; and Spinalis Capitis, which links cervical spinous processes with the occiput. This description follows the conventional paradigm for spinalis, however experts differ on the morphology of the cervicis and capitis portions. A recent edition of *Gray's Anatomy* (Williams, et al. 1989:589) describes spinalis cervicis and capitis as "variably blended with semispinalis" and "often absent." Rosse and Gaddum-Rosse (1997:135) state that spinalis cervicis is frequently absent and that spinalis capitis "is not a separate muscle." Our laboratory observations showed that these muscles are occasionally distinct.

This study uses a categorization system to describe the morphological variability in the upper spinalis muscles and to provide frequency estimates for each variant. Data are drawn from cadaver dissections associated with the instruction of human gross anatomy. Frequency estimates are based upon a sample of size of about 50 individuals. Data are collected from both sexes and from both sides of the body.

Three variants are described for both Spinalis Capitis and Spinalis Cervicis: absent, blended with semispinalis, and distinct. Our preliminary investigations show that "absent" is the most common variant for Spinalis Capitis, occurring about twice as often as the "blended" type, while the "distinct" variety is less common (appearing in less than 10% of cases). Observations for Spinalis Cervicis show that the "absent" and "distinct" variants occur in approximately equal frequencies, while less than a fifth of the sample possess the "blended" version. These findings suggest that the blended and distinct forms of both muscles are more common than was previously supposed. Further analysis will compare frequencies between sides and sexes. These findings will help to refine the understanding of variation in the muscles of the neck.

Cerebrospinal fluid concentrations of large neutral amino acids and monoamine metabolites in *Macaca mulatta*: effects of single high protein meals and venous tyrosine infusions. M.A. GRIMES[1], J.L. CAMERON[2], J.D. FERNSTROM[2], [1]Pennsylvania State University, University Park, PA 16802, [2]University of Pittsburgh, Pittsburgh PA 15213.

The link between diet, plasma amino acids, brain amino acids that serve as precursors for neurotransmitters and neurotransmitter synthesis has been hypothesized to provide the brain with a signal of the animal's dietary protein status, and diet-induced alterations in neurotransmitters, e.g. serotonin, catecholamines, are thought to function in protein regulation by affecting feeding behavior. Previously, our laboratory has investigated the impact of chronic protein intake on plasma and cerebrospinal (CSF) concentrations of tyrosine (TYR), tryptophan (TRP) and the other large neutral amino acids (LNAA), and on CSF concentrations of 5-hydroxyindoleacetic acid (5HIAA, the principle metabolite of serotonin) and homovanillic acid (HVA, a principle metabolite of dopamine), in juvenile male rhesus monkeys. The animals consumed for four sequential 4-week periods diets differing in protein content (~23%-~16%-~10%-~6%, [%-energy] ). To mimic feeding patterns in the wild, the daily ration was presented as a morning meal of fruit, and an afternoon meal of fruit and monkey chow. During week 4 on each diet, blood and CSF were sampled over two, sequential 24-hour periods. The plasma and CSF concentrations of each LNAA varied diurnally, and with dietary protein content, while CSF 5HIAA varied with dietary protein content and CSF HVA was not effected by diet.

The results of two follow-up experiments are reported here. The first was designed to compare the acute effect of a single high protein meal (35% protein) on neurotransmitter precursors and metabolites when monkeys were maintained for at least 4 weeks on either a high (~23%) or low protein diet (~6%). The

high protein meal resulted in significant elevations in plasma and CSF concentration for all LNAA, but no change in CSF 5HIAA and HVA. The magnitude of change observed in CSF levels of all LNAA was significantly less compared to animals consuming the same meal but maintained on the high protein diet (~23%).

The second experiment explored the effect of venous infusions of TYR, alanine and saline on feeding behavior in animals on a low protein diet (~6%). A venous infusion of TYR resulted in a dramatic elevation in plasma TYR, but only a slight increase in CSF TYR levels. There was no effect of infusion type (TYR, alanine or saline) on measures of feeding behavior.

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Linear enamel hypoplasia and life history in Cayo Santiago rhesus monkeys. D. GUATELLI-STEINBERG, University of Oregon, Eugene, OR 97403.

This study tests two hypotheses concerning the influence of non-human primate life history variables on linear enamel hypoplasia (LEH), a dental indicator of systemic physiologic stress. The first hypothesis is that members of low-ranking matrilines will have higher LEH frequencies than members of high-ranking matrilines. The second is that animals transferred into captivity at an early age will exhibit higher LEH frequencies than their free-ranging counterparts. This study makes use of the extensive life history database of the Cayo Santiago rhesus macaque skeletal collection. Previous studies have focused primarily on prevalence rather than etiology because the life history data for most skeletal collections is limited.

The free-ranging sample consists of 201 specimens; the captive sample consists of 44 specimens. An individual scored positive for LEH if a defect on a permanent tooth could be matched with a defect on its antimere (the corresponding tooth on the opposite side of the jaw). Defects were rated as "mild" or "pronounced" based on their width or depth. Free-ranging individuals belonging to matrilines in the bottom third of the dominance hierarchy during the tooth formation period were classified as low-ranking while those in the top third were considered high-ranking. Individuals transferred into captivity during the years of tooth formation and living in captivity for one year or more made up the captive sample.

In both samples, the lower P3 is most often affected. LEH is significantly associated with dominance rank, supporting the first hypothesis. Of 36 high-ranking individuals, only 3 scored positive for LEH, all of the mild type. Of 49 low-ranking individuals, 12 scored positive for LEH, of which 8 exhibited pronounced defects. The second hypothesis is not substantiated: LEH is not significantly associated with transfer into captivity.

This data supports the connection between dominance rank and physiologic stress noted by others using different measures. The author plans to test the first hypothesis on an expanded sample. Preferential LEH expression on the lower P3 is a pattern that has not yet been reported.

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Ukraine Neolithic cemeteries: dental anthropological analysis of twelve sites. A.M. HAEUSSLER, Arizona State University, Tempe, AZ 85287-2402.

Following a practice that began in Mesolithic times, Neolithic peoples living in what is now Ukraine buried their dead in cemeteries. Common to most of these cemeteries is their proximity to the Dnieper River, lack of an associated habitation site, and red ocher.

Analysis of dental morphological trait frequencies from twelve sites, nine of them on the Dnieper River, indicates intra-regional heterogeneity of the Neolithic samples and some similarity to the Mesolithic Ukraine frequencies. Percentages of traits indicating reduction in tooth and cusp numbers and relative cusp size generally follow a pattern of dental reduction from the Mesolithic to the Neolithic eras. However, Jacobs' metric analysis of four of these samples shows an increase in the mesiodistal and buccolingual dimensions.

As was the case in the Mesolithic Ukraine samples, variations in the frequency of hypoplasia ranging from 0.0% in Igren', Vasil'evka II, Mariupol', Vovnigi I, Chapli, Mikha'lovka, and Privol'noe to 53.8% in Yasinovatka Pit B indicate differential pathology producing stress. Archaeological and biochemical reports indicate the cultivation of cereal grains, but the near absence of caries, abscess, and periodontal disease indicates that grains were not being processed to the extent that they produced these pathogen associated diseases.

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Evolution of pads and claws in New World anthropoids. M.W. HAMRICK, Department of Anthropology, Kent State University, Kent, OH 44242.

This study tests predicted morphoclines in finger tip morphology among four small-bodied New World monkeys (Saimiri sciureus, Leontopithecus rosalia, Callithrix jacchus, and Saguinus oedipus) in order to test previous functional and adaptive explanations for the evolution of flattened nails and expanded apical pads within the Order Primates. Small-bodied platyrrhines which frequently forage among small-diameter substrates are expected to possess 1) relatively expanded apical pads, 2) well-developed epidermal ridges, 3) distally broad terminal phalanges, and 4) reduced flexor and extensor tubercles compared to those species which use large-diameter arboreal supports more frequently for their locomotor and postural behaviors. These predictions were tested using both a morphometric analysis of terminal phalanx shape and a comparative histological study of apical pad epidermal morphology.

Results show that as the frequency of small-branch foraging increases among taxa within this sample relative distal phalanx breadth also increases but distal phalanx length, height, and flexor tubercle size decrease. Moreover,

epidermal ridge development becomes more pronounced as the frequency of small-branch foraging increases. Both terminal phalanx breadth and epidermal ridge complexity are positively correlated with apical pad size in this sample of New World monkeys. Apical pad size in turn appears to be positively correlated with stability of the digit on small-diameter supports.

This study suggests that subtle differences in terminal phalanx morphology are tightly correlated with subtle differences in substrate use and foraging behavior among these New World monkeys. These observations corroborate the hypothesis that expanded apical pads are required for habitual locomotor and postural behaviors on small-diameter supports whereas keeled tegulae are more useful for positional behaviors on large-diameter substrates. Finally, the observed morphoclines demonstrate that a gradient in form from claw- to nail-like tegulae exists among these taxa. Thus, the distinction between claw- and nail-bearing platyrrhines is essentially arbitrary.

Using computer technology for 3D visualization and delivery of natural history objects. C. C. HANSEN, Center for Scientific Imaging and Photography, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

The Center for Scientific Imaging and Photography has an on-going project where we have developed methods to aid in the visualization of three-dimensional museum objects for research and educational purposes. Its concept involves the electronic delivery of museum objects to researchers and educators, world wide, in a form that is second only to having the actual objects in-hand. This is a collaborative effort with colleagues at the Natural History Museum, the National Zoo's Bio-Visualization Lab and the Digital Research and Imaging Lab at Mississippi State University. In addition we are involved in a networking project, with Texas A&M University, the National Library of Medicine and MCI demonstrating the use of ATM networks, the internet, and InternetII as fast delivery methods for the large 3D files produced. This work represents a significant advance in the application of three-dimensional modeling and visualization to physical anthropology, morphology and systematic biology, especially in areas such as feature identification, measurement and comparative study. The potential to create exciting, object based delivery of museum material to researchers and educators via the Internet and/or closed networks is demonstrated on our web site: photo3d.si.edu.

Tooth mineralization standards for the mandibular third molar in American blacks and whites. E. F. HARRIS, University of Tennessee, Memphis, TN 38163.

The rate of tooth mineralization is under significant genetic control, though the tempo can be modulated environmentally. The orderly progression—in concert with the long span during growth in which the teeth form—makes "dental age" a useful measure of a person's degree of maturity. The third molar is of particular interest because (1) it is the last and most variable tooth to form; (2) it is the only tooth to complete formation after the onset of puberty; and (3) it is virtually the only maturity indicator that bounds the ages of 18 and 21 years, which makes it attractive in forensic and legal circles as an estimator of adulthood. Age standards are described here for mandibular third molar formation stages in a cross-sectional sample of 2,415 persons (age range: 3 to 25 yrs), with proportionate sample sizes of American blacks and whites and males and females. The 15-grade formation scheme of Moorrees *et al.* (*J. Dent. Res.*, 1963) was used, and descriptive statistics were computed using lognormal parametric survival analysis. Blacks achieved each stage significantly ahead of whites, with an average difference of 1.2 yrs for both males and females. The race difference exceeded sexual dimorphism, which averaged 0.3 yr. In both races, formation proceeded faster in males, with increased dimorphism after the onset of steroid-mediated puberty.

Grade-specific standards are provided by race and sex. Formation starts at about 9 yrs with initial cusp formation and ends with root apex closure at a mean age of 19 in blacks and 22 in whites. Sample variance increases with stage of formation, such that 95% confidence limits span 8 or more years for root formation stages (of most interest for forensic and legal purposes). Consequently, the third molar provides a rough gauge of an individual's chronological age, but the considerable variability precludes any precise claim, particularly in late adolescence where most legal interest has focused.

Mitochondrial Variation in the Nasioi of Bougainville K.L. HECKMAN (Michigan), J. FRIEDLAENDER (Temple), and D.A. MERRIWETHER (Michigan)

Archaeological evidence indicates that the island of Bougainville was first inhabited 29,000 years ago, presumably giving rise to non-Austronesian-speaking Melanesians. The non-Austronesian Nasioi are located in the southern region of the island and have close ties to nearby Austronesian (Polynesian) populations

In this study, blood was drawn from 518 individuals during 1967, 1970, and 1985 field seasons of the Harvard Solomon Island Expeditions. Recently, we extracted DNA from the 172 unrelated individuals in this sample. RFLP and PCR analysis of this sample showed that 50.4% possessed the Region V 9 bp deletion (associated with the Polynesian motif described by Lum et al., 1994). Some 42% of the Nasioi possessed the Alu I 10397 and Dde I 10394 site gains and 59.7% possessed a site gain at Hae III 16517. The high frequency of the 9 bp suggests that there has been significant admixture with Austronesian groups (presumably the nearby Uruava and Torau speakers on the East Coast of Bougainville).

We have sequenced the mtDNA control region (also known as the D-loop) for a subset of these individuals between nucleotides 15975 and 00430. The D-loop

sequences from 9 bp deleted individuals are compared with published Polynesian 9-bp deleted sequences. We characterize a series of mutations in the non-deleted D-loop sequences to define the "indigenous" non-Austronesian Melanesian lineages present in the Nasioi.. We also describe within and between village mtDNA variation between the Nasioi from the Aropa Valley, and from the villages of Bairima, Pomaua, and Sieronji.

This work was supported in part by NSF Award Number 9601020, the Department of Human Genetics at the University of Pittsburgh, and the Department of Anthropology at the University of Michigan.

A preliminary assessment of human skeletal remains of slaves from Newton Plantation, Barbados, West Indies. KS HERNDON, Department of Anthropology, Southern Illinois University, Carbondale, IL 62901

The postcranial skeletal remains of over 50 enslaved Afro-Caribbean individuals from Newton Plantation, Barbados, West Indies, have been analyzed in terms of demography, disease and nutrition. This sample represents the only slave cemetery located in Barbados to date, and perhaps the largest early slave cemetery in the Caribbean. While previous studies have found relatively high levels of various pathological indicators in the dentitions such as linear enamel hypoplasia and root hypercementosis, present preliminary findings suggest relatively low levels of periostitis, osteomyelitis, arthritis and trauma. However, some unique pathologies also appear in low frequency among these individuals. Taken together, these findings may further shed light on the treatment and social statuses of enslaved African Americans on a sugar plantation over a 200 year period.

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The biology of poverty: Skeletal and documentary evidence from the Monroe County Poorhouse. R.L. HIGGINS, SUNY College at Potsdam, NY, 13676, L. WALSH, Colonial Williamsburgh Foundation, Severna Park, MD 21146, M. HAINES, Colgate University, Hamilton, NY 13346, J.E. SIRIANNI, University at Buffalo, NY.

The Highland Park skeletal collection has been useful in providing insight into the living conditions of the nineteenth century institutionalized poor. Both skeletal and documentary evidence is utilized in this study to assess the utility of the Health Index devised by Steckel et al.

High mortality in the middle of the nineteenth century was apparently characteristic of the nation as a whole. Analyses of the historic records for the Monroe County Poorhouse and of the associated skeletal sample suggest that living conditions there were far from adequate. Mortality rates were high and infectious diseases were the leading killers. Frequencies of infectious lesions and degenerative joint disease were high in this sample, while frequencies of cribra orbitalia, porotic hyperostosis and enamel hypoplasia were low. The results of the Health Index place the Monroe County Poorhouse Cemetery just about average in terms of the maximum attainable score and higher than that of the St. Thomas Anglican Church sample. High rates of infectious disease were characteristic of both the city of Rochester and the poorhouse. Such diseases as cholera and measles do not leave any trace in the skeletal record and are not measured by the Health Index.

These results suggest that, when available, documentary evidence should be factored into the Health Index. If those data had been considered in the calculation for this sample, the score would likely have declined. Furthermore, it is important to realize that this score (if adjusted to include documentary evidence) likely says more about the condition of poverty than it does about conditions at the poorhouse. Given the short duration of stay typical of most inmates (usually a matter of days), nutritional deficiencies and disease were likely the cause of institutionalization rather than the consequence.

Oral and postcranial bone-loss patterns at 1-year recall. C.F. HILDEBOLT, M. DOTSON, N. YOKOYAMA-CROTHERS, J. MUCKERMAN, T.K. PILGRAM, J. HAUSER, S. COHEN, E. KARDARIS, M. VANNIER, R. CIVITELLI (Washington Univ., St. Louis), J. HANES, M. SHROUT (Medical College of Georgia, Augusta).

In a double-blind, longitudinal study of 96 postmenopausal women (mean age = 59 ±6.2), (1) alveolar bone radiodensity, (2) cementoenamel-alveolar crest (CEJ-AC) distances, (3) bone mineral densities (BMDs) of the lumbar spine (anterior-posterior plus lateral) and femur, and (4) smoking habit (packs/day times years smoked) were tested for associations. Inclusion criteria were at least 10 teeth, no periodontal pockets ≥ 5 mm, and good health. Alveolar bone radiodensities and CEJ-AC distances were measured from digital images of dental radiographs. BMDs were determined with dual X-ray absorptiometry. Measurement change from baseline to year-1 recall was entered into analyses. All patients received calcium supplement and half of the patients estrogen therapy.

Mean BMD increased slightly [mean difference between baseline and 1-year recall for Lateral BMD was 0.022 gm/cm$^2$ (+3.98%); the values for Total BMD were 0.010 gm/cm$^2$ (+1.63%)]. Mean CEJ-AC distances decreased slightly [mesial measurements = -0.020 mm (-0.19%); distal measurements = -0.027 mm (-0.95%)], and alveolar-bone radiodensity decreased slightly (-19.33 arbitrary units(-0.10%).

Current smokers began the study with the lowest levels of bone, and continued to show bone loss. Ex-smokers, however, showed the highest levels of bone gain. Changes in BMD were weakly correlated with CEJ-AC distances (r = -0.10 to -0.15). Changes in total BMD were moderately correlated with changes in alveolar-bone radiodensity (r=-0.31), as were distal CEJ-AC measurment changes (r = 0.28). In conclusion, alveolar-bone radiodensity change was related to BMD change, with the relationship between changes in BMDs and CEJ-AC distances being weaker.

This study was supported by National Institute of Dental Research grant DE09861.

The age-at-death distribution of Indian Knoll: how should it be estimated? N.P. HERRMANN, Department of Anthropology, The University of Tennessee, Knoxville, TN 37996

The estimation of an age-at-death distribution from skeletal material is a problematic procedure. Recently, Jackes (AJPA 68:281-299) proposed a method for estimating and smoothing age-at-death distributions employing standard normal probability distributions for each stage of the indicator. Several researchers have demonstrated that age-at-death distributions derived from these types of procedures are biased as a result of an *a priori* assumption equating the age-at-death distributions of the reference and skeletal samples. In addition, the assumption of normal age distributions for each stage of an indicator is suspect. Employing maximum likelihood to estimate a hazard model of mortality provides an unbiased age-at-death distribution with respect to the reference sample.

In this paper, I estimate age-at-death distributions from Todd pubic symphysis stage data compiled from Dr. Charles E. Snow's original coding sheets for Indian Knoll, an Archaic shell mound from Kentucky. These distributions are calculated according to a Siler hazard model of mortality and Jackes' method employing Dr. Judy Suchey's known age symphysis data as a reference sample (n = 739). The competing hazard parameters of the Siler model are obtained from a cumulative probit model that allows for uncertainty of individual age estimates.

Both age-at-death distributions constructed differ from the previously reported demographic profiles for Indian Knoll which were based on dental attrition, cranial suture closure and the McKern and Stewart pubic symphysis method. For example, Jackes' method displays a marked mortality peak at age 20. These differences as well as a comparison of the two age-at-death distributions are highlighted and discussed.

An Initial Craniometric Examination of the Origins and Inter-Regional Impacts of Oxus Civilization Populations from the North Bactrian Oasis of Central Asia. B.E. HEMPHILL, Dept. of Anthropology, Vanderbilt University, Nashville, TN 37235.

Discovery of a previously unknown Bronze Age civilization centered on the oases of Central Asia immediately raised questions concerning the origin and inter-regional impacts of this civilization. Fifteen cranial measurements from 12 Bronze Age samples, encompassing 544 adults from Central Asia, Iran, the Indus Valley, and Anatolia were compared to test which, if any, of the current hypotheses offered by archaeologists are best supported by the pattern of phenetic affinities possessed by the Oxus Civilization inhabitants of the north Bactrian oasis. Craniometric differences between samples were compared with Mahalanobis generalized distance ($D^2$) and patterns of phenetic affinity were assessed with two types of cluster analysis, multidimensional scaling, and principal coordinates analysis. Results indicate that current hypotheses for both the origin and inter-regional impacts of Oxus Civilization populations are incomplete.

Oxus Civilization populations are not the product of wholesale transplantation of either northern Iranian or Indus Valley populations. Rather, Oxus Civilization populations of the north Bactrian oasis reflect more complex origins that involve gene flow into an extant oasis population, not only from northern Iranian-affiliated populations to the west, but also from an as yet unknown population. Oxus Civilization populations did not exert a unilateral impact upon neighboring Bronze Age populations. Rather, these populations appear to have participated in a bidirectional exchange network across the Indo-Iranian borderlands. However, the nature of this interaction-- at least with regard to gene flow, appears to have been more limited, both in intensity and in geographic scope, than expected.

Koalas and primates: What can one learn about primate origins and adaptations by observing koalas. M. HENNEBERG, K.M. LAMBERT, C. DE MIGUEL and J. HAYNES Dept. Anatomical Sciences, University of Adelaide, Adelaide 5005 Australia, and M. LAVELLE, Univ. of Rhode Island, Kingston, RI 02881

Australia is naturally devoid of primates. Their niches have been occupied by marsupials, especially possums and koalas (*Phascolarctos cinereus*). Koalas are 4-12 kg tailless animals with grasping hands and feet who climb up into the crowns of the trees and feed on their leaves. Dominant males claim territories occupied by a number of females. Younger peripheral males engage in dominance fights with older males. Territory is marked with secretions of pectoral glands and with rasping calls. Although the oldest fossils of koalas are dated at 15 Ma it is clear from the general history of marsupial and eutherian evolution that koalas and primates must have separated at least 70 Ma ago. In early 1996 we have commenced a program of comparative anatomical studies of koalas. Dermatoglyphic prints of hands, feet, fingers and toes of 67 juvenile and adult koalas of both sexes revealed the presence of dermal ridges histologically very similar to these of humans. The average width of the ridge is 513 µm compared to human 486 µm. Koala ridges contain Meissner's corpuscles - tactile nerve endings similar to humans. Only tips of koala digits are regularly covered with dermal ridges forming patterns of arches, loops and whorls. Other areas of palmar and pedal skin are commonly covered with broken dermal ridges forming series of dots, called "warts" although at times these dots coalesce into ridges forming true dermatoglyphic patterns. This is similar to arrangements found in some prosimians. Koalas have fully opposable clawless big toes while the second and third pedal digits are partly fused (syndactylous) with their claws

forming a grooming tool. In koala hands the first two digits are opposed to the remaining three providing a very firm grip. Observed in the wild koalas display fine motor control moving each limb separately, grasping and bringing small twigs to the mouth . The wide range of the upper limb movement is aided by the presence of a clavicle. Their preferred posture is that of sitting vertically in forks of bigger branches, while during climbing they maintain a typical vertical clinging posture. Koalas also perform perfect vertical leaps between two tree trunks. Brains of koalas have an average volume of 26.65 ml (males, N=17) and 23.81 ml (females, N=8) which compared with body weights of 9.1 kg in males and 6.6 kg in females produce encephalisation quotients slightly higher than in basal marsupials, but lower than in prosimians (lorises and lemurs). The study of koalas allows us to better assess which primate characteristics are a result of adaptations to the arboreal way of life and which are of phylogenetic nature.

Variation in the closure of the sacral canal in the skeletal sample from Pompeii, Italy, 79 AD. R.J. HENNEBERG and M. HENNEBERG, University of Adelaide, Adelaide 5005, Australia

Closure of the spinal sacral canal is one of the most variable aspects of human anatomy. Frequencies of the fusion of posterior arches of various sacral segments differ widely between populations from various geographic regions and time periods. Some authors report 50% of S1 posterior arches to be unfused, while others give figures below 2%. It is also debatable whether various degrees of the non-closure of posterior sacral arches are pathological or just a normal variation. Lack of the uniformity of methods used by various authors and terminological debates (e.g. correct use of *spina bifida occulta*) complicate the issue even further.

We have examined 124 adult sacra of 70 males and 54 females who died in Pompeii during the 79 AD eruption of Vesuvius. There were four sacra (3%) with a completely open spinal canal. The entirely fused canal - S1 to S5 inclusive - was found in 11% of the sacra. The most common condition (47%) was when only the posterior arch of S5 was open. The combination of open S5 and S4 was present in another 35%. Opening of the sacral canal reaching from S5 to S3 was present in 4% of individuals. Among all sacra 8% had unfused posterior arches of S1 irrespective of the degree of the spinal canal closure at other levels. No sexual dimorphism was noted.

The sample of sacra from Pompeii seems to fall within the range reported for other populations even with the uncertainties regarding differences in methods used by various authors. Due to its frequent occurrence incomplete closure of the sacral canal can hardly be considered a true, disabling pathological condition.

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Multivariate estimations of body length in humans, African apes and fossil hominids. S.M. HENS, University of Tennessee, Knoxville, TN 37996.

Because of methodological problems, determination of living stature or body length from skeletal remains continues to be problematic. In particular, the rationales for choosing reference samples and regression methods are unclear. This paper explores estimates derived from five different multivariate regression techniques. These methods encompass the Model I type regressions (least squares with both inverse and classical methods of calibration) and the Model II type regressions (major axis and reduced major axis) as well as the long bone to body length ratio. The different regression models are tested in a case of extreme extrapolation. I use parameters from a large human sample (n=2,209) to predict stature in a sample of apes and the parameters derived from the ape sample (n=85) to predict stature in the humans. This shows the performance of each regression technique when extrapolation beyond the range of the reference sample is required for estimation, as is often the case with fossil samples. Lastly, I applied all five regression techniques to A.L. 288-1 ("Lucy") and W.T. 15000 ("The Boy") fossil hominids. As the actual statures for these specimens are unknown, these examples are instructive, but inconclusive.

Based on the root mean-squared error (RMSE), classical calibration is the preferred estimator for body length in the Great Ape sample (when using human parameters) and in the modern human sample (when using Great Ape parameters). This occurs because classical calibration takes an uninformative prior for body length in these cases of extreme extrapolation. The bias shows that the humans were underestimated by 1.4 cm using the ape parameters, but the apes were overestimated by 3.9 cm when using the human parameters.

Finally, the classical calibration method was also the preferred estimator for Lucy with two separate reference populations: a sample of modern human pygmies (n=18) and the Great Ape sample. The stature of "The Boy" was best predicted by the long bone/stature ratio model with the modern human reference sample. This was expected due to the similar humeral and femoral allometries between "The Boy" and the modern humans.

Evidence for a tail in *Proconsul heseloni*. T. HARRISON, Department of Anthropology, New York University, New York, NY 10003.

Ward *et al.* (1991) have suggested that *Proconsul* did not have a tail based on comparisons of a purported last sacral vertebra (V42) of a subadult individual from the Kaswanga Primate Site (KPS) on Rusinga Island. Their analysis of the degree of tapering of the vertebral body suggests that the caudal surface could only accommodate coccygeal vertebrae. This discovery has recently been used to support the phylogenetic placement of *Proconsul* as an early hominoid, and to propose functional and behavioral models that might serve to explain the initial development of taillessness in apes. Although the fragmentary and distorted nature of the

specimen makes comparisons problematic, my re-examination of the V42 vertebra provides a contradictory interpretation. Reconstruction of the caudal surface of the vertebral body suggests that it was trapezoidal in shape, rather than almost circular, and nearly as broad as the cranial surface, with only a slight posterior tapering of the vertebral body. Moreover, several key morphological features of the specimen (i.e., the extent of attachment of the transverse process, the shape and dorsoventral depth of the centrum, and the development of longitudinal keels on the ventral surface) indicate that V42 should be identified as a caudal vertebra, probably a first caudal, rather than as a last sacral element. Rather than providing evidence that *Proconsul* did not have a tail, I would contend that this specimen provides definitive proof that it did, indeed, have one.

Fortunately, the case does not rest on a single poorly-preserved specimen. Two additional caudal vertebrae (V9 and V10), previously undescribed, have also been recovered from KPS. Since these are morphologically and metrically consistent with a primate the size of *P. heseloni*, which is overwhelmingly the preponderant mammalian species at the site, it seems reasonable to assume that these can be referred to this taxon. V9 and V10 are comparable in morphology to the caudal vertebrae of Old World monkeys (in the region of the fourth to sixth caudal vertebrae), and they confirm that *Proconsul* had a relatively long external tail.

From a phylogenetic perspective, the discovery that *Proconsul* had a tail provides additional support for the inference that this taxon does not belong to the crown clade comprising all extant hominoids. However, it does not help resolve the much more critical question of whether *Proconsul* is a stem hominoid or a primitive catarrhine. This will have to await the results of detailed comparative analyses of other cranial and postcranial complexes which are currently underway.

Reproductive life history variation in macaques. W.C. HARTWIG, San Francisco College of Osteopathic Medicine, San Francisco, CA 94115.

Life history traits clearly relate to adaptive differences among species because they afford opportunities for increased reproductive output and/or critical metabolic adjustments in growth rate. Primate life history traits frequently are incorporated into accounts of adaptation and directional change even though reliable data on key variables are few and difficult to obtain. The tendency to look for patterns in uncritically accepted species mean values often overrides the resolving power of the data themselves.

In this study data on adult body weight, neonatal body weight, gestation length, age at first reproduction, interbirth interval, and age at weaning were collected for eight macaque species. Calculations of prenatal growth rate, postnatal growth rate and relative neonatal size were derived from these values. These data were analyzed both objectively (without regard to their likely accuracy) and subjectively (reduced to a subset of "most accurate" mean values). In both cases gaps in the database are numerous and reflect the great amount of basic life history data that remain to be collected.

Macaques were chosen because they are the only Old World monkey genus for which substantial life history data are available and because they represent a theoretically very generalized radiation of anthropoid primates. Previous work on macaque life history has stressed the significance of differences in breeding rate among species and the correlation of these differences to stresses induced by different habitats. However, the data collected for this study indicate that intraspecific variation in macaque reproductive life history traits exceeds interspecific variation and, more importantly, no general predictions of directional change in macaque life history are supported. Rather, *Macaca* is best considered a baseline catarrhine genus which opportunistically has colonized a wide variety of habitats in the Holocene Old World as a result of the generalized and resilient life history strategies of its geographically emergent species.

Dental eruption sequence among colobine primates. K. HARVATI, Lehman College and the Graduate School, CUNY/NYCEP, New York, NY 10036.

Faster growth in body weight among folivorous colobine primates compared to frugivorous primates of similar body size is thought to be related to diet, as well as to behavioral and risk factors (Leigh 1994). Dental development is one aspect of growth that is linked to diet and to life history but has not been investigated among colobines since the work of Schultz (1935).

This study established the dental eruption sequence for several colobine species and compared it to that of other catarrhines. The variability in the eruption sequence among colobines was assessed. Two hundred forty juvenile colobine specimens from AMNH and NMNH were scored for presence or absence of permanent teeth and for stages of partial eruption.

African colobines, represented by *C. guereza*, *C. angolensis* and *P. badius*, were found to erupt M2 before I2, and *C. angolensis*, also before I1. The canine is delayed, erupting after the premolars in females and after M3 in males. Asian colobines show greater diversity in their eruption sequences. *Nasalis* shows no early eruption of the molars and is very similar to *Macaca* in its eruption sequence. *Trachypithecus* and *Pygathrix* erupt $M^2$ before $I^2$. The canine in *Trachypithecus* is delayed, erupting after the premolars and, in some males, after M3. *Presbytis* erupts M2 before both incisors; the M3 erupts before C in both sexes, but in females often even earlier, before both premolars.

Although the timing of eruption is not known, all colobine species examined here except *N. larvatus* showed some degree of early relative eruption of M2 and M3. This may be related to the dietary adaptation of folivory and could be linked to faster growth rates in folivorous primates. The lack of this tendency in *Nasalis* sets this genus apart not only from the Asian colobines, but also from the African group, as represented in this study.

Mismatch distributions of mtDNA may not reveal recent human population expansions. J. HAWKS, Dept. of Anthropology, University of Michigan, Ann Arbor, MI 48109.

A theory of the distribution of pairwise genetic differences, or mismatch distribution, has been developed to infer the demographic histories of natural populations, using the coalescent algorithm (Hudson 1990) to derive expectations under different demographic hypotheses. Human mtDNA mismatch distributions are typically unimodal, with lower means in local samples than in the worldwide sample. This pattern has been claimed to be consistent with a "weak Garden of Eden" hypothesis, in which ancestral humans spread from a restricted source population some 100,000 years ago, followed by dramatic population expansions starting around 50,000 years ago (Harpending et al. 1993).

The current study evaluates this hypothesis with respect to coalescent theory. First, over 500,000 simulations of the coalescent process were performed to derive predictions for the mismatch distributions of local samples taken from a geographically dispersed population. It was found that unimodal distributions with low means relative to the global mean are the expected result of local sampling, regardless of past demography. Local mismatch distributions therefore cannot test global demographic hypotheses, and a "weak Garden of Eden" hypothesis is not supported over alternative hypotheses by human mtDNA sequence data.

Second, the effect of past positive selection on mismatch distributions was estimated from 1,000,000 coalescent replicates. With a long-term worldwide $N_e = 100,000$ as suggested by HLA data (Ayala 1995), a selection coefficient as low as 0.005 was found to be sufficient to replicate empirical human mismatch distributions. A "selective sweep" of a single advantageous haplotype therefore remains a credible explanation for the low mtDNA diversity observed in living humans.

Finally, standard errors for equilibrium and other demographic models were calculated and found to be very large. The ability of mismatch distributions to discriminate among hypotheses of demographic history is therefore quite limited.

Mitochondrial DNA variation of ancient Aleuts. M.G. HAYES, Laboratory of Biological Anthropology, University of Utah, Salt Lake City, UT 84112

Ancient Aleuts have been classified into two distinct cranial types based upon cranial index. Earlier forms are dolichocranic and later forms are brachycranic. Hrdlicka (1945) hypothesized these two temporally separated cranial types represent a replacement of the former "Pre-Aleuts" by later "Aleuts" from the Alaskan mainland. Laughlin (1980 and elsewhere) hypothesized that the two types represent in situ evolution from "Paleo-Aleuts" to "Neo-Aleuts."

Ancient DNA was extracted from rib samples of both brachycranic and dolichocranic skeletons collected by Hrdlicka in the 1930's from Umnak Island, Kagamil Island, and Shiprock Island in the Aleutian island chain. Regions of the mitochondrial DNA (mtDNA) genome containing restriction site polymorphisms and the 9bp deletion characterizing ubiquitous Native American lineages were amplified using PCR, and scored for the presence or absence of these markers.

Preliminary results indicate the dolichocranic (Pre- or Paleo-Aleut) samples are characterized by approximately 25% haplogroup A, and 75% haplogroup D. This distribution does not substantially differ from contemporary Aleuts on Pribilof Island who are characterized by 25% haplogroup A and 66.7% haplogroup D (Merriwether et al 1995).

This research is supported by grants and fellowships from the University of Utah and the Natural Sciences and Engineering Research Council of Canada. Access to samples was afforded by the National Museum of Natural History.

A demographic analysis of northern and western European mesolithic cemeteries. E.H. HARMON, Arizona State University, Tempe, AZ 85287.

The appearance of cemeteries in some areas of Europe during the late Mesolithic provides a significant resource for evaluating prehistoric paleodemography. Little is known of population structure and mortality trends during the European Mesolithic. This study presents demographic profiles for seven mesolithic cemeteries from northern and western Europe ranging in size from fourteen to over one hundred individuals. The purpose is to provide a critical analysis of overall mortality and differential survivorship by sex and age which can be applied to broader issues in mesolithic hunter-gatherer research.

Results of demographic assessments derived from published burial data reveal both similarities and differences among the cemeteries. In general, subadults under 15 years of age are underrepresented, constituting less than 30% of most cemetery populations. Combined life expectancy parallels that of the mesolithic mean reported by Acsádi and Nemeskéri (1970). The modal value of life span, however, varies across cemeteries. Male and female mortality profiles differ from one another, and from one cemetery to the next.

Although commonalties exist, the variability among cemeteries suggests that a single characterization of

mesolithic mortality is inappropriate. These patterns and others are discussed within the framework of the extinct cultural systems of which they once were a part.

The interface between muscle and bone: biomechanical implications. J. HIRSCHBERG, N. MILNE and C. E. OXNARD, University of Western Australia, WA, Australia 6009.

The morphology of the muscle/bone interface is complex and ranges from insertions of muscle on bone through a periosteal membrane or ligament, to attachments of tendon to bone incorporating perforating fibres passing through intermediate fibrocartilaginous and mineralized cartilaginous elements. The degrading processes of bone maceration and fossilisation generally remove most of the intervening non-osseous materials. This reveals convexities and concavities on the bony surface that can be studied by using a hand lens and by employing light and scanning electron microscopy. That such surface features must be related to the biomechanical situation has always seemed obvious. But their complexity, especially the presence of both convexities and concavities combined in the same attachment region, makes biomechanical interpretation difficult.

Attempts are made here using computational stress and strain analyses through FLAC (Fast La Grangian Analysis of Continua) to define the mechanical situation in a series of increasingly complex simulations of the anatomical structures. The results show that both convexities and concavities of surface topology are related to the precise form and angle of attachment of tendons and to the stresses that are applied. Thus, the combination of longitudinal compression in bone and tension in tendon creates almost uniform stresses at the bony surface around either a pit or a tubercle. When the complexity of the model is increased so that tendon forces are applied through deeply penetrating fibres, the surface stresses are further reduced. Under such circumstances, the highest stresses are deep within the bone and this may explain why many tendon avulsions involve failure of the bone itself, not the tendon/bone interface. Other factors involved are: differences in tendon angulation, presence of a periosteal sleeve, differences in elastic moduli from tendon to bone, thickness and contour of intervening fibrocartilage when present, and type, thickness and contours of subjacent bone. Information from such models may improve functional inferences about muscle action from observations about bony surfaces in dried bones and fossils.

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Dominance and female affiliative patterns in rhesus macaques (*M. mulatta*): An assessment of stable social relations in Old World monkey females. N. B. HARRINGTON, Department of Anthropology, University of Oregon at Eugene, OR 97403.

This study explores and tests the mechanisms for and elements of a successfully stable social group, using two of Seyfarth's (1977, *J. theor. Biol.* 65:671-698) five criteria of female partner choice in affiliative behaviors. These five criteria include: 1) dominance, 2) individual personality, 3) available time, 4) kinship, 5) presence of an infant. The two deemed most important and available for testing in this macaque troop include dominance and kinship. The existence of the concept of dominance as a prevailing force in the analysis of non-human primate social groups is questioned to a certain extent as well.

One social group of rhesus macaques was observed on Cayo Santiago during the winter of 1996, and statistical tests were applied to the frequency of partner choices for all adult females in the troop during two behaviors: grooming and sitting in proximity.

It was initially hypothesized that kinship would play a greater role in partner choice than dominance, although more statistical significance was found among relations based on rank. But the role of kinship is considered an important factor for several reasons: rhesus macaque female dominance hierarchies are based on kinship lines; kinship based on paternal lines are a factor even though they are usually discounted due to difficulty of determination; in contrast to other study groups, this troop has stayed relatively intact for the extent of each of the members' lives and the dominance hierarchy is also stable relative to others studied; specific group dynamics present an exception to the strict youngest ascendancy rule of dominance hierarchy formation. For these reasons, dominance and kinship were determined to equally influence female partner choice in this stable social group.

Nesting behavior: implications for determining group dynamics of mountain gorillas in Bwindi-Impenetrable National Park, Uganda. A.E. HANKE, and M.L. GOLDSMITH, Dept. of Anthropology, Dartmouth College, Hanover, NH 03755.

The nesting behavior of gorillas (*Gorilla gorilla beringei*) in Bwindi-Impenetrable National Park in southwestern Uganda was examined from January through February 1997. The study was based on the analysis of nightly nest sites constructed by two habituated gorilla groups: the Buhoma group (n = 14) at a low elevation (1,450 m) and the Ruhija group (n = 13) at a high elevation (2,100 m). The goal of the project was to describe nesting behavior and group dynamics within nest sites.

All nests built by the Buhoma gorillas were on the ground compared to only 31% of the nests in Ruhija. For both groups, nest construction was dominated by one or two plant species. On at least one occasion, both groups built new nests in previously used nest site areas. However, in one instance, a single nest within a site was reused on consecutive nights by a member of the Ruhija group.

The gorillas at Buhoma nested in a more cohesive fashion (mean nest site area = 340 $m^2$) than the gorillas at Ruhija (mean nest site area = 868 $m^2$). Furthermore, most individuals of the Buhoma group nested within a 10 m radius of the silverback, having a mean nearest neighbor distance of 3.0 m. Only 19% of the time was a lactating female the nearest neighbor (mean distance of lactating females from the silverback = 8.7 m). For the Ruhija group, most individuals nested within a 15 m radius of the silverback, having a mean nearest neighbor distance of 4.3

m. Lactating females were the silverback's nearest neighbor 33% of the time (mean distance of lactating females from the silverback = 13.6 m). For both groups there was no correlation between a lactating female's distance from the silverback and either the age of the female or her infant.

In sum, the Buhoma group showed less arboreal nesting behavior, more cohesive nest sites, and shorter distances between lactating females and silverbacks when compared to the Ruhija group. These findings may be due to differences in vegetation between the two sites, with the Buhoma group spending more time in large, herbaceous vegetation areas, resulting from forest clearing activities.

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Forensic photograph/live subject comparisons: Application of appropriate statistical tests. R.A. HALBERSTEIN and L.L. TAYLOR, University of Miami, Coral Gables, FL 33124-2005.

Forensic photography, the identification of persons from photographic evidence, involves the comparison of live crime suspects with perpetrators captured on video tape surveillance. Anthropometric indices (e.g., craniofacial and body/physique measurements) are utilized to assess the degree of similarity between the live person and the video image of the perpetrator in the commission of the crime. Nonparametric statistical tests for significance of results have been less than robust, due to the nature of the data--two individuals with a matched series of proportional measurements (nasal width/head width, facial height/head height, etc.). In the present study, greater reliability and accuracy in subject comparisons were achieved in three separate cases using the McNemar test. This test, designed to test for the significance of differences between correlated proportions of nominal scale measurements, is applicable to before- and-after comparisons when subjects serve as their own controls.

Forensic data were collected in three armed robbery cases from metropolitan southern Florida. Subjects under arrest were assessed with 12 anthropometric indices of the head and body. These indices were then compared with analogous proportions obtained from video images of the perpetrator recorded at the crime scene. In each case the statistical significance of the data, as determined with the McNemar test, corresponded with the final judgment of guilt or innocence. These findings suggest that the McNemar test may be the most appropriate statistical test in forensic photography identifications.

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A 25-year update on T. Dale Stewart's "Perspectives on problems of early man common to America and Australia." R.L. HALL, Department of Anthropology, Oregon State University, Corvallis, Oregon 97331-6403.

Twenty-five years ago in a symposium in Sydney, Australia, to honor Grafton Elliot Smith, T. Dale Stewart summarized approaches and information concerning the earliest settlers of the Americas and Australia and argued for a common examination. In the last 25 years many developments -- from technological breakthroughs that allow more detailed genetic analyses to new discoveries and theories concerning the antiquity of anatomically modern humans -- have reinforced the importance of research on these two sets of populations, despite obvious differences between Australasia and the Americas such as size and diversity of land masses and climates.

Using the categories Stewart addressed -- dating issues; physical features of first New World humans; changes in New World populations (including anthropometric variability, blood-group patterns, and disease susceptibility) -- this paper provides an update and introduces the symposium "Biological Variation and Population Origins in the Americas and Australasia."

While dates of original settlement have been pushed back in both areas, earliest dates are still not clear nor are routes of entry resolved; models based on known successful migrations are being developed. Papers in the symposium present recent findings of population variation with use of genetic techniques, additional skeletal material, and computerized methods unavailable 25 years ago. Stewart's paper and this symposium offer works-in-progress on a topic that contributes to our theoretical understanding of our species as well as to the particular history of American and Australasian populations.

Sex-based differences in dental pathology rates in two Sudanese Nubian cemeteries. Y.K. HALLEIN, Department of Anthropology, University of Colorado at Boulder, Boulder, CO 80309.

Numerous studies of prehistoric populations have demonstrated that the distribution of dental pathologies varies depending on the sex of an individual. Hillson (1978), Frayer (1989), Lukacs (1992), as well as many others, have done studies demonstrating that females tend to be more susceptible to caries than males. Cutress et al. (1988) and Danenberg et al. (1991) found that males tend to be more likely to have periodontal disease than females in the same population. The males also tend to have more abscessing than do females, as demonstrated by Swardstedt (1966), Hillson (1986) and Lukacs (1992), although this varies from one population to the next. This study evaluated the prevalence of caries, abscesses, calculus, tooth loss, and periodontal disease between males and females, both in and between two Christian Nubian cemeteries from the site of Kulubnarti, Sudan.

The sample consisted of 90 individuals, 45 females and 45 males, and the data was collected by visual observation from both the skulls and using radiographs of the mandibles and maxillae. The data was analyzed using Student's T and chi-square tests.

The results showed that in general the females were more stressed and in poorer oral health than the males in either cemetery. Overall, the females had more bone loss, more caries of all kinds, more calculus development, and more antemortem tooth loss. Only in abscess development were the males more likely to be affected and this was only a slight difference. While the overall trend was for females to be in poorer dental health, there was a dietary shift between the early and late cemetery that altered the type of dental stress the females were subjected to. This shift resulted in a decrease in periodontal infection, bone loss, and antemortem tooth loss, and an increase in the number of dental caries.

Oral pathology in a southeastern Mississippian period site. M.D. HAMILTON and M.K. MARKS, University of Tennessee, Knoxville 37996-0720.

For this research, 591 dentitions from the Averbuch site (A.D. 1150-1350), a Late Mississippian period cemetery from central Tennessee were examined and scored for a series of dental and oral pathological conditions. The quality of diet and overall health, as well as the effectiveness of a particular subsistence strategy can be readily interpreted by examining the dental and oral structures. Previous research on this collection examining non-dental markers of disease has revealed the fact that the Averbuch population presents evidence for very low health levels (Buikstra 1992, Eisenberg 1986), and this present research was undertaken in an effort to lend additional insight into the health status of this archaeological population.

The pathological variables examined for this research include dental caries, enamel hypoplastic defects, antemortem tooth loss, macrowear, periapical and periodontal abscessing, and alveolar bone resorption. Analysis of the findings reveals that among the individual permanent adult dentitions, antemortem tooth loss rates were at 36%, caries rates at 66%, abscesses at 15%, hypoplasias at 85%, and alveolar resorption levels at 39%.

The resulting dental profile demonstrates that the relatively high rates of oral macropathology present in this group characterize a population with decreased adaptive efficiency and increased stress and disease levels. Diet and subsistence methods are implicated as the main factors contributing to this finding.

Nested cladistic analysis of human Y chromosome variation: Out of Africa and back again. M.F. HAMMER,[1] T. KARAFET,[1] A. RASANAYAGAM,[1] E.T. WOOD,[1] T.K. ALTHEIDE,[1] T. JENKINS,[3] R.C. GRIFFITHS,[4] A.R. TEMPLETON,[5] and S.L. ZEGURA.[2] [1]Laboratory of Molecular Systematics and Evolution, and [2]Department of Anthropology, University of Arizona, Tucson, AZ; [3]Department of Human Genetics, University of Witwatersrand, Johannesburg, S. Africa; [4]Mathematics Department, Monash University, Clayton, Australia; [5]Department of Biology, Washington University, St. Louis, MO.

Non-recombining genetic systems are particularly useful for addressing questions concerning human evolution. We surveyed nine di-allelic polymorphic sites on the Y chromosomes of 1,544 individuals from Africa, Asia, Europe, Oceania, and the New World. Phylogenetic analyses of these nine sites resulted in a tree for 10 distinct Y haplotypes with a coalescence time of ~194,000 years. The 10 haplotypes were unevenly distributed among human populations: five were restricted to a particular continent, two were shared between Africa and Europe, one was present only in the Old World, and two were found in all geographic regions surveyed. The ancestral haplotype was limited to African populations. Random permutation procedures revealed statistically significant patterns of geographical structuring of this paternal genetic variation. The results of a nested cladistic analysis indicated that these geographical associations arose through a combination of processes including restricted, recurrent gene flow (isolation by distance) and range expansions. We inferred that the second oldest event in the nested cladistic analysis was a range expansion out of Africa which resulted in the complete replacement of Y chromosomes throughout the Old World, a finding consistent with many versions of the Out of Africa Replacement Model. A second and more recent range expansion brought Asian Y chromosomes back to Africa without replacing the indigenous African male gene pool. Thus, the high levels of observed Y chromosomal genetic diversity in Africa may be due in part to bi-directional population movements. Finally, a comparison of our results with those from nested cladistic analyses of human mtDNA and ß-globin data revealed different patterns of inferences for males and females concerning the relative roles of population history (range expansions) and population structure (recurrent gene flow), thereby adding a new sex-specific component to models of human evolution.

Anthropologic Perspective of Hyperostosis Frontalis Interna. C.M GREENWALD, L. JELLEMA, Cleveland Museum of Natural History, Ohio (44106), I. HERSHKOVITZ, Anatomy/Anthropology, Sackler Faculty of Medicine, Tel Aviv University, 69978, Israel, O. DUTOUR, Universite de la Mediterranee, Marseille, France (13385) and B.M. ROTHSCHILD, Arthritis Center of Northeast Ohio, Youngstown, OH 44512.

Hyperostosis Frontalis Interna (HFI) is the accretion of bone on the inner table of the frontal bone. Ambiguity as to its character stimulated evaluation of 1,706 early 20th century skulls (1007 males and 699 females) from the Hamann-Todd (CMNH) and Terry (Smithsonian) human osteological collections, 512 pre-19th century Levant and 1012 Amerindian and cadaver skulls.

Graded changes ranged from isolated, discrete frontal foci to extensive continuous overgrowth with post-frontal extension. HFI occurs in 24% of 20th century females and is age-dependent. It is less frequent (5%) in males, most manifesting mild changes. Type-predicted analysis by cohort reveals significant ethnic differences. Changes in Afroamerican appear earlier and are more extensive than in Euroamerican females. Hyperostosis Cranii Diffusa (HCD) is a separate phenomenon, associated with generally thicker bone, and ethnicity-based, while HFI is not.

X-ray analysis shows a discrepancy between the anatomic prevalence of HFI and radiologic recognition, very poor for mild cases. This apparently resulted in the previous false impressions that HFI is an old age phenomena and 90% female predominant.

HFI is rare in the pre-18th century skulls studied. This phenomena, which originates in mid-adult individuals, apparently only reached its current population frequency in this century. It is five times more common in contemporary females. Cadaver study suggest that predilection for the frontal area may be related to altered blood supply/vascular stretching.

Participatory Action Research: Effectiveness of a student-led fruit and vegetable stand in an urban Philadelphia middle school. P. GORDON-LARSEN, F.E. JOHNSTON, T. DUBOWITZ, and D. GERBER
University of Pennsylvania, Philadelphia, PA 19104.

Overweight and obesity are the primary nutritional problems in America and are of particular public health concern due to the rapid increase in their prevalence over the past few decades in U.S. adults, children, and adolescents. Prevalence of obesity (BMI and triceps skinfold > 85th percentile NHANES I) amongst 392 urban Philadelphia middle school students (11-15 years) is disproportionately high for males (24%) and females (34%). In addition, 24-hour dietary recall data (N=345) indicate that the majority of these youths exceed U.S. dietary goals for total fat (84%), saturated fat (75%), and cholesterol (54%) and consume a diet low in fruits and vegetables.

A Participatory Action Research (PAR) project, aimed at providing a sustainable framework for informed decision making by the students in matters related to their diet and health, was instituted at the middle school. One component of the PAR project is a school-based, student-run fruit and vegetable stand. A school store curriculum, involving nutrition education, food preparation and distribution, advertising, and small business management, was established in two classrooms of students (N=60).

Effectiveness of this nutritional intervention in changing fruit and vegetable consumption was assessed by comparing the subsample of students enrolled in the school store classroom (N=60) to an uninvolved sample of adolescents (N=135). Results indicate increased use amongst the involved students compared to those not involved ($p \leq 0.001$), but no difference between the two groups in more frequent visits (2-5 visits per month) to the fruit and vegetable stand. Participation was important in promoting visits to the store, and once a visit had been made, subsequent ones were likely to occur.

The present study demonstrates the effectiveness of the PAR approach in increasing the availability of fruits and vegetables in the middle school and the positive impact on those students directly involved in the school store curriculum and students who visit the stand at least once.

The effect of reproductive seasonality and the absence of rank effect on scent marking behavior in naturally occurring adult male ringtailed lemurs (*Lemur catta*). L. GOULD, Okanagan University College, British Columbia, Canada, V1V-1V7.

In prosimian primates, scent marking and olfactory communication are used extensively. Scent marking can provide both a spatial and temporal record of the movements of an individual animal or a social group. In this study, scent marking behavior among adult males in three groups of naturally occurring ringtailed lemurs was studied at the Beza Mahafaly Reserve in southwestern Madagascar. Rates of scent marking behavior differed significantly according to reproductive season. Resident males engaged in more scent marking behavior during mating and migration seasons, when males from other groups were in close proximity, either attempting to gain extra-group matings or immigrate into new social groups. The higher rate of scent marking during mating season may be an indirect form of reproductive competition. During migration season, increased scent marking is suggested to be a form of home range defense. Rates of scent marking were lowest during the post-migration season. Dominance rank did not affect the rates of scent marking behaviors. This finding is contrary to most reports of mammalian scent marking patterns where high rank correlates with high rates of marking behavior, and in this case might be explained by the highly unstable male dominance hierarchy that existed in all three study groups during the 12-month study period.

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